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October 13, 1998

Ms. Magalie Roman Salas
Office of the Secretary
Federal Communications Commission
1919 M Street, N.W.
Washington, DC 20554

Dear Madam Secretary:

On behalf of Zenith Electronics Corporation, I am pleased to submit the enclosed original and nine copies of Zenith's Comments in response to the Notice of Proposed Rulemaking in the Matter of Carriage of the Transmissions of Digital Television Broadcast Solutions, CS Docket No. 98-120. Thank you for forwarding copies to the Chairman and Commissioners.

Cordially,

Cc: Mr. Ben Golant, FCC
Mr. Tom Sorensen, Zenith

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ZENITH ELECTRONICS CORPORATION

zenith

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**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20054**

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In the Matter of)

**Carriage of the Transmissions
of Digital Television Broadcast
Stations**)

CS Docket No. 98-120

**Amendments to Part 76
of the Commission's Rules**)

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**COMMENTS OF
ZENITH ELECTRONICS CORPORATION**

Zenith Electronics Corporation respectfully submits these comments on the above-captioned Notice of Proposed Rule Making (Notice) released July 10, 1998. Zenith is a long-time leader in consumer electronics and cable technologies, and the developer of the digital television (DTV) transmission subsystem adopted by the Commission as part of the Advanced Television Systems Committee (ATSC) DTV Standard.

I. SUMMARY OF ZENITH'S COMMENTS AND RECOMMENDATIONS

Zenith, as a member of the Consumer Electronics Manufacturers Association (CEMA), actively participates in CEMA's open standards activities and supports many of the comments filed by CEMA in its response to this docket.

In formulating our comments and recommendations, Zenith considers the interests of consumers to be overarching. Central to our thinking are equipment costs, ease-of-installing and connecting home digital equipment, the costs of receiving digital television (DTV), and especially high definition television (HDTV) programming, and the minimization of consumer confusion when operating their DTV receivers.

Zenith believes that the rapid and smooth transition to DTV and the related return of analog spectrum requires the cooperation of all parties that deliver television programming, not just broadcasters, but also satellite and cable operators. Because the majority of U.S. homes depend on cable to deliver local channels, the cable industry should be required to cooperate within two key areas:

- (1) At the outset of DTV transition, 100 percent of the free DTV offerings of all terrestrial broadcasters must be available to all consumers who rely on television service via cable systems. Moreover, all the programs provided by the broadcasters must be available to users without any dilution of the many merits of DTV -- noise-free and ghost-free reception, video and audio fidelity far superior to that available with our current NTSC analog delivery systems and ancillary television and data services (many of which are yet to be conceived) offered by the near 20 megabit-per-second (Mbps) pipeline to the home.
- (2) Low cost, minimal equipment (ideally none) peripheral to consumer DTV receivers, and simplicity of connecting the coaxial cable entering the home to the DTV receivers must be assured.

The *means* to connect cable systems to DTV receivers are readily available. The real question is the *willingness* of cable systems to provide the proper signals and interconnection necessary for reception and uncompromised display. The availability of proper DTV signals, consumer-friendly interconnection and non-degraded digital information should be as important to cable-originated programming as they are to programming provided by over-the-air transmissions.

Connection of a consumer's existing coaxial cable to a DTV receiver should be no more difficult or expensive than what exists today for analog signals; that is, connection of a single coax to the RF input jack of the DTV receiver. To accomplish this and retain the consumer-friendly features of DTV receivers, digital signals provided by the cable system simply should be modulated using the ATSC modulation system being used by all broadcasters. Cable operators should be required to "pass-through" the broadcasters' ATSC signal, just as many smaller TV stations will be passing-through DTV signals provided by the networks.

In cases where cable operators need to enable conditional access via set-top boxes, the output should again be ATSC-compliant for direct connection to the RF input available on every ATSC DTV receiver. Interconnectivity in this manner represents *no* incremental cost in consumer DTV receivers. All that is required in the set-top box is an *ATSC Remodulator*, the functionality of which is equivalent to NTSC remodulators which are an integral part of every consumer VCR and tens of millions of cable boxes deployed in the US. Recognition of this simple, low-cost solution to interconnectivity has led consumer manufacturers to standardize the *ATSC Remodulator* via EIA-762, "DTV Remodulator Specification."

The *ATSC Remodulator* is a *universal DTV interconnect*, as it enables direct connection of digital VCRs, digital satellite receivers, DVDs, computers and the like to ATSC DTV receivers. Therefore, we urge the Commission to require the use of the ATSC modulation standard by cable for broadcast carriage, as recommended by its own Advisory Committee on Advanced Television Service (ACATS) in 1995.¹ To do anything less will certainly delay deployment of DTV, delay spectrum reclamation and place major, but unnecessary, burdens on US consumers.

¹ Allowing the cable industry to use a modulation system different from that deployed by DTV broadcasters and DTV receiver manufacturers would be comparable in the analog domain to allowing cable to transmit, for example, PAL signals while broadcasters use NTSC.

II. OBSERVATIONS

Commission's Authority and Obligation. Zenith believes the Commission not only has the authority and ability to develop rules to facilitate the transition process, but is obligated to provide the direction to assure that the best interests of consumers are served. There are conflicting agendas among the various participants: cable, broadcasters, content providers, computer manufacturers and television manufacturers. Some of these can distort the market process to their advantage and stifle competition necessary for the market process to properly function.

Consumer Interests. Previous Must-Carry rules for analog transmission, as upheld by the United States Supreme Court, set an important precedent for digital cable transmission requirements. To speed the transition to digital broadcasting and, more important, to best serve consumer interests, the Commission should impose similar rules for DTV signals. In the Introduction of the Notice, it was affirmed that cost and service to the consumer are important issues. Zenith believes that such consumer requirements must clearly take precedence over various business interests.

Lack of Industry Consensus. Zenith concurs that participation of the cable industry in the transition to DTV is essential. Despite the cable industry's extensive participation and support within the Commission's ACATS through the final system selection, the cable industry chose a different channel coding (modulation) standard, an action that Zenith believes threatens to delay the widespread implementation of DTV in the U.S.

Pursuant to the 1992 Communications Act, the consumer electronics industry, through its trade association, CEMA, joined with the National Cable Television Association (NCTA) to form a Joint Engineering Committee (JEC) to develop standards and specifications for interfaces between set-back devices for *analog* scrambling systems and television receivers. The result of this effort was EIA-105, Parts 1 and 2.

CEMA, which has cable equipment manufacturers as members, is a recognized American National Standards Institute (ANSI) standards organization. Through the years, CEMA has developed receiver specifications for operation on cable systems; however, in recent years the cable industry has worked through Cable Television Laboratories, Inc., (CableLabs), which is not an ANSI standards organization, and through the Society of Cable and Telecommunications Engineers (SCTE), which only recently has been

recognized by ANSI. CableLabs has not worked with CEMA.

Central Role Of Television Receivers. Digital television receivers must work with and interconnect to a multitude of other devices such as VCRs, DVD players, computers, satellite receivers, and audio equipment – not just cable navigation devices. Recognizing this, CEMA has defined common interface solutions through its *open* standards setting processes which include both its *open* standards committees (R-4.0 and its subcommittees) and the JEC. To avoid potential negative consequences for consumers, CEMA must take the lead in establishing optimum interconnection standards.

Cable industry participation also is essential, but it must be bilateral. The cable industry continues to attempt to develop standards for interconnectivity between video source devices and television receiver/display equipment. The television industry must accommodate all video sources, including their interconnectivity requirements and, therefore, must take the lead while working with cable and other industries to make effective consumer interface standards. Again, we urge the Commission to focus on the consumer. Lack of consensus around consumer-friendly interfaces would result in additional costs for consumers because of added receiver interface equipment for which there may be minimal perceived value for many consumers.

III. DIGITAL COMPATIBILITY

Choice of Technology Drives DTV Compatibility. We could not agree more with the Commission's observation that "an understanding how the different technical elements fit together is essential to a discussion of the core digital broadcast signal carriage issues." In fact, the differences between technological approaches has a major impact on consumer costs and ease-of-use, with the wrong choices slowing digital television implementation and delaying the return of the spectrum currently on loan to terrestrial broadcasters.

Therefore, we encourage the Commission to mandate the technical solution for cable/television interconnectivity as recommended to the Commission by its own Advisory Committee (ACATS) in 1995.

The ACATS Process. The comprehensive ACATS process, including its organization structure, recognized at the outset² the requirement for compatibility and appropriate interconnectivity between advanced television receivers and signals provided by media other than terrestrial broadcasting. Not only did the structure specifically include an “Alternative Media Technology” subgroup and leadership roles by members³ of the cable industry, the specific needs of that industry were an integral part of other committees.

During the competitive hardware build-and-test stage, each proponent system included a “cable mode” that would enable properly maintained cable systems (i.e., those meeting the Commission’s carrier-to-noise requirements) to deliver much more data than a terrestrial channel.

As part of the exhaustive testing process established by the ACATS, specific cable testing was done on each competitive system. The tests were defined by members of the cable industry. The test equipment was provided by CableLabs, and the tests were performed by CableLabs employees. The results of the testing were reviewed by members of the cable industry. The cable test results were an integral part of the attempted selection process in February 1993 that eliminated two candidate systems and established a retesting program for the remaining four systems.

ACATS Choice Of Digital Modulation. When the “Grand Alliance” was formed in May 1993 — with the stated goal of achieving the “best-of-the-best” DTV system for the United States — operation on cable was again a major decision criterion. With the overview of the ACATS, and because of the quest for the best-of-the-best system components, the Grand Alliance decided to test the two most promising transmission/modulation system proposals (8VSB/16VSB and 32-QAM/256-QAM). The cable aspects of the testing were done under the auspices of the ACATS by CableLabs. The understanding, both within the Grand Alliance and by the leadership of the ACATS, was

² This was recognized at the start of the process in 1987 even before *digital* advanced television was on the horizon.

³ The ACATS committee membership included executives from Viacom, Post-Newsweek, HBO and American T.V. & Communications. Additionally, its three Sub-Committees and their Working Parties were amply populated with cable operator and cable equipment industry members including several in key chair positions.

that the modulation system showing the best overall performance for *both* terrestrial and cable transmission would become the recommendation of the ACATS to the Commission. It also was clear at the time that the best system for terrestrial and cable transmission would be mandated by the Commission, thereby assuring maximum interoperability (for both the transmit and receive equipment) between broadcast television equipment and cable equipment.

The performance of 8-VSB was found to be superior to that of 32-QAM, and 16-VSB outperformed 256-QAM.^{4,5} The ACATS, recognizing the potential interconnectivity problems if non-compatible systems were to evolve, recommended both the 8-VSB and 16-VSB system to the Commission.⁶ The Commission at that time in its Christmas Eve 1996 Report and Order, mandated 8-VSB for terrestrial broadcast of DTV and elected *not* to mandate any modulation standards for delivery of digital television by the cable industry. The cable industry chose to ignore the recommendations of the ACATS and has been proceeding with its own proprietary QAM systems. Thus, the major basis for today's DTV and HDTV connectivity problem with cable was born.

Delay And Costs To Consumers. Failure to follow the recommendations of the ACATS has, at the very least, resulted in DTV implementation delays and potentially additional costs for including the SCTE-QAM capability in future DTV receivers.

The Notice, at paragraph 22, correctly notes that the cable industry has not embraced the use of 16-VSB. A small minority of cable operators (by published numbers) have committed at this time to use SCTE-QAM. In fact, the number of set-top boxes deployed using the SCTE-QAM transmissions is less than 2 percent of the total number of homes connected to cable. As many cable operators are beginning to understand the benefits to themselves and to their subscribers of using a modulation system common with that used by broadcasters, they are now taking a hard look at using the ATSC

⁴ It should be noted that the QAM system tested then, and standardized today, by the SCTE is one of a family of incompatible (with each other) QAM systems standardized by the ITU (International Telecommunications Union). In addition to the two different versions of SCTE-QAM, there is also a DVB version used extensively in Europe and by the US telco industry.

⁵ The 16-VSB system outperformed the 256-QAM system tested even in spite of the fact that the 256-QAM system provided for test was not designed and built by the Grand Alliance member advocating QAM. Instead, the equipment supplied was military grade supplied by a non-participant in the Grand Alliance and the ACATS.

⁶ In addition, the documentation (A/53) of the digital television standard done at the request of the Commission by the Advanced Television Systems Committee also includes the 16-VSB modulation mode with no mention of any QAM modes.

modulation systems, beginning with the 8-VSB version.

Data Rate Comparisons. Fundamentally and scientifically, data rates between vestigial sideband (VSB) and quadrature amplitude modulation (QAM) systems are identical for comparable robustness in carrier-to-noise ratio (C/N) thresholds. Based on comments relative to “operating efficiency” (net data delivery rates) in paragraph 22 of the Notice, it appears the Commission has been misguided.

For terrestrial broadcasting in a 6-MHz channel, which requires C/N threshold on the order of 15 dB, the Commission’s mandated 8-VSB trellis-coded ATSC system provides deliverable data capability of about 19 Mbps. For cable systems operating in a 6-MHz channel, requiring C/N threshold of about 29 dB, the 16-VSB ATSC system and a 256-QAM system both provide net data capability of about 39 Mbps.

System implementation accounts for minor differences in actual delivery data rate. This was shown in the ACATS and Grand Alliance testing done to determine the best-of-the-best transmission systems. In both the terrestrial tests and the cable tests, the net data rate was slightly greater with VSB than with QAM. There are no data to support an assertion such as “both 64 and 256-QAM likely will provide cable operators with a greater operating efficiency than does 8-VSB, and permits the carriage of a higher data rate, with less bits directed to error correction, when compared with the digital broadcast system.”

It should be noted that the 16-VSB system was thoroughly tested on a variety of real cable systems in Charlotte, N.C., by the ACATS (with CableLabs defining and performing the cable testing) in both 1994 and 1995. Those tests reliably delivered 38.7 Mbps of data, even in systems having C/N performance less than that required by the Commission. In contrast, we are not aware of any publicly available test results of any successful 256 SCTE-QAM system in real cable plants.

Cable Systems Capacity and HITS. At paragraph 24, the Commission asserts “...systems subscribing to HITS [Headend In The Sky] may not necessarily have excess capacity to carry digital signals ...” We would point out that HITS does not prescribe the system’s capacity, and there is no limit to a system’s capacity simply because it is using HITS. HITS is a technology that was developed primarily to avoid the expense of upgrading physical cable plants and to further extend the life of old analog cable plants to deliver VHS quality digital signals. More forward-looking cable operators have incurred

the capital expense of plant upgrades and will have more bandwidth to take advantage of the ATSC system's picture improvements and additional data services.

Set-top Boxes Are Not Critical. At paragraph 25, the Commission notes: "A critical aspect of the digital transmission path involves the digital cable set-top boxes." Set-top boxes are only a critical aspect if the ATSC and SCTE systems remain different. In a separate proceeding, and Report and Order, FCC 98-116 (rel. June 24, 1998), the Commission is requiring the "unbundling" of conditional access and non-security functions, thus further negating the significance of integrated set-top-boxes. In the interest of minimizing overall costs to consumers and cable operators, processing power in a set-top-box should be limited to that required for conditional access. It is the incompatible SCTE modulation system that requires a set-top box or a second demodulator in a digital cable compatible TV.

Pass Through Considerations. We comment on the three "developments" cited in the Notice:

- (1) *the possibility of shared functions between set-top boxes and receivers.* The General Instrument DCT1000 set-top box can only deliver the compressed HDTV digital stream through a proprietary interface for which there is no corresponding DTV receiver interface, nor is there a baseband digital interface, such as IEEE 1394.. Reported plans to deploy millions of these boxes in future years would result in a legacy problem that could deny viewers the full benefit of HDTV originated by cable or from over-the-air signals delivered on cable without replacing the existing boxes. In this situation, the cable industry postulates a solution for later set-tops with no plans for shared functions, reducing the receiver to a featureless monitor/display.
- (2) *the possible lack of processing power and memory in some set-top boxes.* The currently deployed digital cable set-top box cannot process HDTV MPEG signals. As a consequence, again, this could deny viewers the full benefit of HDTV programs, be they cable originated or obtained from broadcasters. A solution, which would enable HDTV to be received and decoded in the DTV receiver, is the inclusion of an inexpensive, add-on ATSC remodulator to the boxes.
- (3) *the possibility of broadcast signals being passed directly through to receivers without any processing by the set-top box.* One solution is to pass the ATSC RF broadcast signal to the DTV receiver and bypass the box. This is a minimal cost solution for the consumer

and the cable operator, and hence a desirable approach.

Conversion To NTSC By Set-Top-Boxes. The digital signals defined in the discussion of cable set-top boxes are 480P only, and HDTV signals are not planned for decompression until 2000. The lack of HDTV capability in the current set-top decoders is key to this discussion because it shows that the currently deployed systems have a shortened life span. CableLabs acknowledges that its HDND specification is an interim solution until the cable set-top box is HDTV capable. We believe that this is further evidence that Commission action, establishing the ATSC standards for cable, would have a minimal financial impact on the cable operators and cable manufacturers that have deployed an under-powered and proprietary system.

Electronic Program Guides. The question of what ancillary data is processed by set-top boxes or the DTV receivers is important. One of the ways in which television receivers are differentiated in the marketplace is through the core features of the receiver on-screen display. Both the cable hardware suppliers and cable operators want to control this rather than have the native display of the television receiver. This is an area of value-added market differentiation for television receiver manufacturers, and its loss would have a severe economic impact on the consumer electronics industry, because market differentiation is difficult for featureless monitors/displays.

DTV Interfaces Should Not Be Mandated. Zenith finds the current Commission's concern for defining a 1394 interface standard in stark contrast to the earlier Commission's disinterest in defining a standard for cable transmission and the standardization of display formats as recommended by the ACATS and as defined in the ATSC Standard (but not incorporated in the Commission ruling). Zenith believes there should be marketplace solutions for DTV interfaces. The 1394 interface deserves a place in differentiated, more featured product where it would be useful.

Yet, there will be a market for both large and small screen DTV products that will be very cost sensitive and for which elaborate interface capabilities will have little (if any) perceived value. In most cases, it makes sense to use the universal interface that will be present on all DTV receivers: the RF input connector. Besides set-top devices there will be VCRs, DVD players and other consumer devices that could be well served by a modulated ATSC (VSB) RF output feeding the DTV receiver. This is a very inex-

pensive solution and has none of the costs associated with 1394 and its cabling.⁷ This interface has been standardized by CEMA through its *open* process as EIA-762, "DTV Remodulator Specification."

Set-top Boxes Must Process All DTV Formats. There is already a significant number of digital set-top boxes that do not have the ability to decode HDTV signals and which have a proprietary interface not compatible with any form of IEEE 1394 (or for any other input for which DTV receivers have been designed). Consumer DTV manufacturers have already pledged to receive and process all 18 scanning formats recommended by the ATSC. In fact, a certification process developed by the ATSC and CEMA will provide consumers the assurance that their display will never go dark as long as any of the 18 formats are transmitted. We believe that this same consumer-oriented approach should apply to cable as well. It would be a disservice to consumers for the Commission to require digital cable set-top boxes to process anything less than all ATSC scanning formats.

Copy Protection is Important. Copy protection should be considered by the Commission in terms of equipment capability. Zenith is working within the Copy Protection Working Group (CPTWG) to help seek consumer-friendly, cost-effective solutions. We urge the commission to recognize that it may take considerable time for the efforts of the CPTWG, the Motion Picture Association of America and CEMA to reach satisfactory solutions. Multi-industry specifications may require new semiconductors, software and product redesign. Widespread implementation in consumer products will take some time as well, and this may have an impact upon product introduction cycles with existing products, creating a legacy issue. Added to this are the uncertainties associated with implementing copy protection functionality in video source devices in other than cable boxes.

⁷ The utilization of any type of baseband interface, such as an IEEE 1394 based interface, adds considerable cost to the digital video source, the digital video receiver/display and the cable required to physically connect the video source devices to the display device. In addition to the use of an expensive computer-type cable (versus a single, low cost coaxial cable), the length of such a digital baseband cable is severely restricted compared to the distance over which RF VSB signals can be reliably transferred.

IV. CARRIAGE

Carriage By Cable Required. Presentation of universally available, locally broadcasted free television is a stated objective of the Commission's rulemaking implementing rapid migration to DTV. Rapid migration enables rapid recovery of precious RF spectrum. The most rapid implementation of DTV can only be achieved by mandating the carriage of all terrestrial broadcasts by all cable operators, which deliver TV signals to almost 70 percent of television households today. And, the most rapid implementation of cable carriage can be achieved by immediately requiring that all cable systems carry all DTV broadcast stations as well as existing analog programming (the "Immediate Carriage" proposal).

Cable Channel Capacity. Zenith acknowledges that channel capacity is an issue for many cable systems. In the near-term, however, digital video compression and robust modulation will provide sufficient channel capacity (bandwidth) for cable operators to carry both digital and analog terrestrially broadcasted programs. In the longer-term, the remaining cable operators will add bandwidth as they rebuild their plants, some of which are 15-20 years old and require rebuilding after refranchising. Zenith asks the Commission to consider three key issues regarding cable channel capacity in the digital world:

- (1) Video compression enables multiple standard-definition programs to be carried in the bandwidth required to carry a single analog program. Compression efficiency is ever increasing, and ten (or more) digital programs in a single 6-MHz channel are happening today using statistical multiplexing technology.
- (2) Use of the high data rate transmission doubles the bit rate in 6-MHz cable channels compared with the data rate achieved in 6-MHz terrestrial channels.
- (3) Both 8-VSB and 16-VSB can be transmitted at substantially less power in cable channels, so digital transmissions can be placed at the extreme upper end of any cable system. In this so-called roll-off region, it is not possible today to transmit the higher powered NTSC analog signals because of excessive distortion.

V. CONCLUSION

To facilitate the rapid and smooth transition to DTV and the related return of analog spectrum, the Commission should require that cable operators carry 100 percent of the free DTV offerings of all terrestrial broadcasters. The digital programs provided by the broadcasters must be available to users without any dilution of the many merits of DTV — noise-free and ghost-free reception, and video and audio fidelity far superior to that available with our current NTSC analog delivery systems, as well as ancillary services. The Commission should look to CEMA to take the lead in establishing market-driven digital interface standards with the goal of low-cost, minimal equipment and simplicity of connecting the coaxial cable entering the home to the DTV receivers.

The availability of proper DTV signals, consumer-friendly interconnection and non-degraded digital information should be as important to cable-originated programming as they are to programming provided by over-the-air transmissions. Set-top boxes should not be required for ATSC DTV receivers to receive broadcast DTV programming on cable systems. Zenith urges the Commission to require the use of the ATSC modulation standard by cable for broadcast carriage, as recommended by its own Advisory Committee on Advanced Television Service. To do anything less will delay DTV deployment, delay spectrum reclamation and place major, unnecessary, burdens on U.S. consumers.

Respectfully submitted,



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